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ABSTRACT

The cost benefits of lifelong learning in the United Kingdom were estimated, based on quantitative evidence. Between 1975-1996, 43 police force areas in England and Wales were studied to determine the effect of wages on crime. It was found that a 10 percent rise in the average pay of those on low pay reduces the overall area property crime rate by between 0.7 and 1.0 percentage points. The benefit was estimated to be between 1.3 and 1.8 billion British pounds per year. Furthermore, the effect on wages of a one point increase in the proportion of the working age area population with a high school diploma or equivalent qualification was predicted to lie between 10 million and 320 million pounds. It was found that cost benefit increases and crime decreases with more education. Parent background, health, and social cohesion were among key factors underlying the relationship between learning, achievement, and crime reduction. Future qualitative studies were recommended to determine more specifically the causal mechanisms and mediating processes that bear on the wider benefits of learning throughout an individual's life. (Seven tables/figures are included. The bibliography lists 53 references. Appended are tables on the relationship between education and training qualifications and wages and a classification of academic and vocational qualifications.) (AJ)

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ED 471 607

WIDER BENEFITS OF LEARNING RESEARCH REPORT NO. 5

Quantitative Estimates of the Social Benefits of Learning, 1: Crime

Leon Feinstein

U.S. DEPARTMENT OF EDUCATION
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Centre for Research on the Wider Benefits of Learning

QUANTITATIVE ESTIMATES OF THE SOCIAL BENEFITS OF LEARNING, 1: CRIME

Leon Feinstein

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The Centre for Research on the Wider Benefits of Learning (WBL) was established in 1999 by the then Department for Education and Employment, now the Department for Education and Skills (DfES). The Centre's task is to investigate the social benefits that learning brings to individual learners and to society as a whole. The Centre is a joint initiative between the Institute of Education and Birkbeck College, University of London.

The views expressed in this work are those of the author and do not necessarily reflect the views of the Department for Education and Skills. All errors and omissions remain those of the author.

Executive Summary

Introduction

1. This report extends the recent work of the Centre for Research on the Wider Benefits of Learning to consider the robust quantitative evidence for links between learning at all stages of the life-cycle and costable outcomes.

2. A great many assumptions are required to develop costed benefits of education based on the information available. In particular, linearity assumptions, partial equilibria assumptions and assumptions of the estimation techniques used are all important. These caveats must be strongly borne in mind in interpreting the results contained in this report. The exercise has been conducted as only a first step in the Centre for Research on the Wider Benefits of Learning's programme of quantitative research. All conclusions are therefore given tentatively and thought of as indicative only.

3. The report stresses the importance of estimation techniques that deal with confounding factors and other sources of bias, particularly the selection bias that results from the fact that people with higher levels of education receive benefits that may be due to a common set of underlying advantages that influence both education and the outcome variables. Econometric techniques are used to deal with this problem.

Key findings on the crime reduction benefits of academic and vocational training

4. A US study has investigated the effect of high school graduation on incarceration. Robust econometric techniques deal with selection and other biases. A ten percentage point rise in the rate of high school graduation would cut the murder (arrest) rate by between 14% and 27%. A 1 percentage point increase in the graduation rate would lead to a reduction in crime of between 34,000 and 68,000 offences, with a social benefit of $0.9 billion to $1.9 billion per annum.

5. A UK study is described that exploits area level crime data for the 43 police force areas of England and Wales (excluding the City of London), 1975-1996, to consider the effect of wages on crime. The study uses a fixed effects method and so is robust to most criticisms of bias.

6. The UK study finds that a 10 percent rise in the average pay of those on low pay in an area reduces the overall area property crime rate by between 0.7 and 1.0 percentage points. This report estimates that this benefit would be worth between £1.3 and £1.8 billion in an average year over the period.

7. Further work undertaken for this report and subject to the many, important caveats made in point 3 above, suggests that the benefit in terms of reduced crime through the effect on wages of a 1 point increase in the proportion of the working age area population with O Level or equivalent qualifications, is predicted to lie between £10 million and £320 million.

8. The benefit if 1 extra percentage point of those in the area population with O Levels, reached A Level or equivalent qualifications and those with O Levels or equivalent who progressed were replaced by those who had previously had no qualifications, is predicted to lie between £80 million and £500 million. Assuming linearity, a 5 point increase would have effects of between £400 million and £2,500 million.

9. If the effects of wages on property crime were applied to other forms of crime, in particular violent crime, the benefits would increase by a factor of 2.7. For example, if the proportion of the working age population with no qualifications was reduced by 1 percentage point and those people achieved A Level or equivalent qualifications, the saving in reduced crime would then be £665 million per year.

Contents

	Acknowledgements		6
1	Introduction		7
	1.1	The virtues and limitations of cost-benefit analysis	7
	1.2	Aspects of learning considered	9
	1.3	Direct and indirect effects	10
	1.4	The applicability of evidence from the US	10
2	The links: theory		11
	2.1	Channels	11
	2.2	Confounding factors and other sources of bias	13
3	Evidence-based benefits of the effects on crime		16
	3.1	Econometric evidence	16
	3.2	Chronic offenders and the developmental perspective	31
4	Concluding remarks		38
	References		39
	References to Table 5		42
	Appendix 1: Relation between area-level education and training qualifications and the log of the 25th percentile of the wage, England and Wales, 2000		44
	Appendix 2: Relation between area-level education qualifications and the log of the 25th percentile of the wage, England and Wales, 2000		45
	Appendix 3: Classification of academic and vocational qualifications used in Appendix 1		46

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1. Introduction

The wider benefits of learning represent a new and exciting topic of study. There is considerable uncertainty about the effects of learning but a widely held belief that many aspects of life are improved by education, with considerable plausible benefits for the economy. There is, however, so far little evidence to support these hypothesised benefits and the evidence that exists is disparate, concerns widely different aspects of learning, based on different measures of learning through different kinds of channels, in different kinds of areas.

Schuller et al. (2001) considered the benefits of learning across a very wide range of domains of potential benefit, in terms of crime, health, parenting, aging and social cohesion. Both quantitative and qualitative evidence was reviewed in order to provide an overview of available evidence and to suggest a conceptual framework for future investigations. This report will focus on crime, describing in more detail the available, robust quantitative evidence and modelling the cost implications of this evidence, i.e. to estimate how much would be saved in terms of the reduced social cost of crime if educational investments were successful. The report draws on the framework provided by Schuller et al. but is more specific about the kind of evidence described. It also goes further in drawing out the implications of the evidence for Government spending decisions[1].

1.1 The virtues and limitations of cost-benefit analysis

The term 'cost-benefit analysis' refers to the attempt to put financial figures to the pros and cons associated with any decision. If the estimated benefit of a project outweighs the predicted cost then an analyst has good grounds to recommend the project.

Not all aspects of the lives of individuals are amenable to the kind of cost-benefit analysis presented here. There are considerable dangers to these methods being applied without concern for their limitations or in inappropriate contexts. House (2000) discusses the infamous 1991 recommendation by the then Chief Economist of the World Bank (the distinguished economist, Laurence Summers) that dirty industries were better sited in less developed countries. The reasoning was that:

[1] A sister report will consider and cost the quantitative evidence for health benefits. Future papers will return to the evidence investigated here and develop new evidence.

> *"the measurement of the costs of health-impairing pollution depends on the foregone earnings from increased morbidity and mortality. From this point of view a given amount of health-impairing pollution should be done with the lowest wages."*

This argument boils down to the suggestion that the health of those in poor countries (with the lowest wages and lowest purchasing power parities) is less important than that of those in richer countries because those in poorer countries are, in economic terms, less productive (i.e. they earn less). The assumption that earnings reflect value itself elides at least two assumptions, firstly that earnings reflect productivity, second that productivity reflects value.

The problem with that analysis is not that it attempts to reduce the relative costs involved in a particular decision to their monetary values, or even that it attempts to apply cost analysis to health but rather that in making its conclusions it fails to take into account the limitations of the resulting analysis for subsequent decision making. In other words, the assumptions are everything. It could be argued that the analysis is justified, as a (relatively small) piece in the puzzle but is hugely insufficient without the necessary additional considerations.

There are dangers in appraisal, evaluation or cost-benefit analysis but, in context, the evidence they can provide is important. Since the instigation by the Treasury of the Comprehensive Spending Review in 1998, UK Government departments are required to look at the effectiveness of spending. It is not a sufficient basis for departments to argue for spending on the basis of tradition, ideology or conjecture. Evidence-based policy requires that, where possible, spending decisions are made on the basis of evidence about the relative effectiveness of the available policy options. One might believe, for example, that education or training programmes would reduce crime but in order to determine how much should be spent on such programmes, it is important to know by how much they might reduce crime and what the resulting savings of such crime reduction might be. The Treasury 'Green Book' (HMSO, 1997), which guides departments in their contributions to the Spending Review process gives a clear statement of the limitations and value of any evaluation or appraisal technique:

> *"Although a great deal of information can be brought within and presented in terms of a formal framework, this can never do more than inform the final decision. Analysis can show how alternative choices compare in many ways, but there will always be further strategic, or pragmatic issues to which those responsible for final decisions must also give weight."* (HMSO, 1997)

This current report is an attempt to inform policy-makers and others about the potential monetary benefits of higher levels of educational participation in terms of reduced levels of crime. That requires a detailed examination of the evidence for a link, based on a theoretical understanding of the underpinnings of that link. The link is then matched to estimates of the cost of crime to provide formal evidence about the likely effectiveness of educational interventions in reducing crime in cash terms.

A great many assumptions are necessary along the way and it is important to emphasise heavily the point that the results presented here represent work in progress. The data is not yet available to achieve what is really the objective here, namely to estimate the effect of education on criminal activity, even if it is possible to surmount all the estimation difficulties that result from the fact that there is no natural experiment in which to base the analysis.

Given the lack of suitable data, this study is forced to link disparate results from different data-sets, being as careful as possible about the process of linking, recognising and making explicit the large uncertainty that is introduced by taking results from different data-sets, at different time-periods. The results presented here are, therefore, intended to provide some guide about plausible magnitudes of effects. They are not thought of as precise estimates of the true relation.

This introduction will briefly describe the framework adopted for the report. Section 2 will describe the overall picture or jigsaw puzzle of the wider benefits of learning with respect to crime. Section 3 will summarise and cost the quantified evidence, putting into place the available pieces of this section of the puzzle.

1.2 Aspects of learning considered

The term 'learning' refers to an extremely broad set of potential educational experiences and interventions. The priority in this report is to consider:

i) educational interventions, primarily but not exclusively academic and vocational training, leading to qualifications, and;

ii) specific formal but not necessarily assessed or certified interventions such as educational programmes for prisoners.

This limitation is not driven by any theoretical or ethical consideration but by simple empirical necessity - the objective is to summarise the robust quantitative evidence. Only certain kinds of learning have been evaluated in the necessary ways.

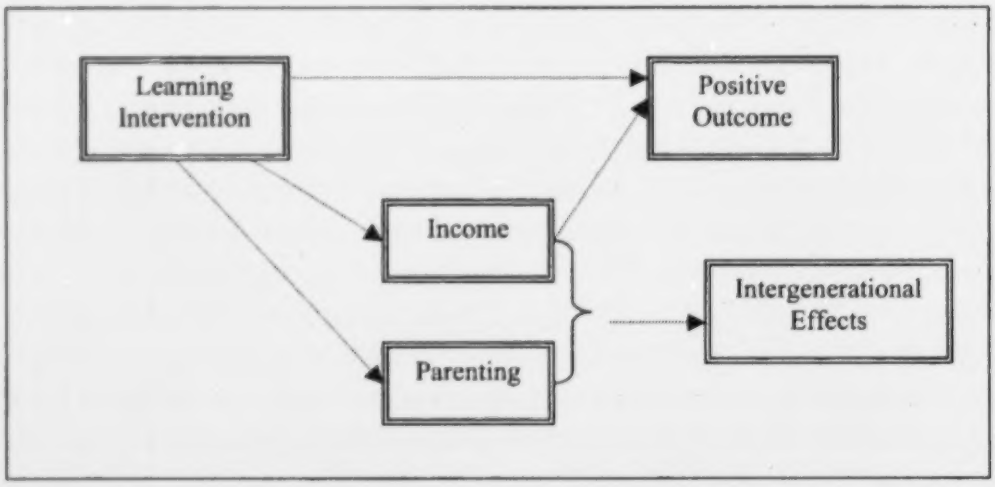
It must also be pointed out that, for simplicity, the terms 'education', 'schooling' and 'learning' are sometimes used without clear demarcation or discussion of the precise differences in meaning except where necessary for precision. The distinctions are important but better dealt with elsewhere.

1.3 Direct and indirect effects

Section 2 on theory will provide a brief description of the hypothesised benefits of learning. It is pointed out here however, that as Figure 1 (below) emphasises, there are essentially three main channels through which learning effects are modelled.

Perhaps the most interesting aspect is the direct effect, the way in which learning changes the way we live. Although particularly interesting, this area is particularly under-researched quantitatively. This report therefore, focuses primarily on the income and parenting effects of learning. The income effect is crucial because the link between education and income is well established. It is possible to merge this information with other evidence on the link between income and crime and on the costs of crime. The result is an evidence-based, costed benefit of education.

Figure 1: Direct and indirect effects of learning



There is also a well-established body of evidence about the importance of early years and parenting interventions. These are included here but it is emphasised that the studies from which such results are derived are commonly based on small samples and from programmes which it would be extremely difficult to replicate on a national scale.

1.4 The applicability of evidence from the US

Most quantitative evidence comes from American studies. This is partly because of the quality of data available and the quality and funding of the research community but also because the large population and Federal system allow the possibility of using inter-state variation to identify robust policy effects. This evidence gives some very useful results but there is a clear difficulty in assuming that the findings will apply to the UK. Given that research on the wider benefits of learning is so new that robust findings are in short supply, it has been decided that it is helpful to include American findings in this study.

2. The links: theory

There are a number of reasons why education and other learning interventions may have an affect on crime (Figure 1, p. 6). Some of these effects are direct, through changes in behaviour or preferences, others indirect, through resulting changes in opportunities, particularly through income. This section, therefore, clarifies the links that have been hypothesised and indicate the relative strength of evidence available for each of these links.

It is important to recognise that a simple correlation between education and the outcomes of interest may mask a number of possible effects that may not be due to education. This section, therefore, also describes possible confounding factors so as to clarify the extent to which even multivariate analyses may mislead. Section 3 provides the detailed evidence.

2.1 Channels

This report gives five potential channels for an effect of education on crime:

1. **The income effect.**
   Through its effect on income, education raises the opportunity cost of time spent engaged in criminal activity or in subsequent incarceration. In other words it reduces the ratio of incentives to risks. According to sociological 'strain theory' (Merton, 1938), income also reduces the frustration that might otherwise lead to crime. Those who can earn more are hence less likely to engage in crime. Since education increases potential wages, it reduces crime indirectly.

2. **Direct effects on patience and/or risk aversion.**
   Patience and risk-aversion are central to the economic model of decision-making including that of participation in crime (see, for example, Lochner & Moretti). Future returns from activities are discounted according to one's patience in waiting for

them. Thus, individuals with a lot of patience have low discount rates and value future earnings more highly than those with high discount rates. If education reduces discount rates (increases patience) it reduces the propensity to commit crime since potential punishments extend into the future and the threat of future punishments will bear more heavily in any decision on whether or not to engage in crime. Of course, patience is difficult to observe directly in large data sets and so the magnitude of this effect has not been estimated quantitatively.
Second, education will reduce crime if it increases risk aversion. Again there is little evidence.

3. **Direct effects on the return to crime.**
To the extent that education increases the earnings one can derive from crime, the association of crime and education is positively influenced. The positive association of education and white-collar crime is an interesting and under-researched area but it is also plausible that there is an effect of training and skills on property crime. For example, in US individual level data, Levitt and Lochner (2000) find that controlling for a number of important family background, region and ethnicity factors, males with higher maths scores commit fewer offences but those with higher scores on mechanical information tests had increased offence rates. This is compatible with the fact that mathematical ability finds returns only in the legitimate labour market, while mechanical knowledge also finds returns in crime.

4. **Delinquency and the direct effects on the pleasure gained from crime.**
The role of pleasure in the determination of crime is most important for teenage crime, i.e. for delinquency. In the Cambridge study, Farrington (2001) reports that when asked their own reasons for criminal participation, teenagers talk about enjoyment whereas older men talk about the material returns to the activity. However, since most crime is committed by teenagers (see the well-known age-crime curve) the pleasure factor is extremely important and one must attempt to address the question of what role education might play in mitigating this aspect.

One might consider here the effect of education and learning on empathy but perhaps more immediately empirically tractable is the effect of being in school on limiting the opportunity for participating in the pleasurable activity of crime. Also important is the role of education in the selection of peer groups. Farrington reports the very strong finding that whereas crime committed by those over 17 is mainly solitary, that pre-17 is mainly in groups. This issue is returned to in Section 3.1.2 where the crime reduction benefits of increasing educational participation amongst teenagers are estimated.

5. **The inter-generational effect.**
   Farrington et al (1996) have established that offending is strongly concentrated in families so that, for example, in the Cambridge study, half of all convictions were accounted for by 6% of families. The causal mechanism for this intergenerational transmission of offending is not well understood, although Farrington et al. also find that 61% of convicted mothers in the study were married to convicted fathers, as opposed to 23% of unconvicted mothers. In other words, offending runs in families but this may be for environmental or genetic reasons or, more likely, unknown combinations of the two[2]. Clearly, cultural factors such as parental expectations, intergenerational learning and family ethics are also important here as are income and employment constraints and opportunities as suggested by the economic literature.

Whatever the level of criminality of parents, there is evidence that parenting skills have implications for the criminality of their children although, again, the nature of this relation is not well understood. For example, skills such as erratic or harsh discipline, low supervision or maternal rejection (Rutter et al., 1998; Daag 1991; Sampson & Laub, 1993) have been shown to be associated with subsequent criminal involvement. To the extent that these are associated with education, an inter-generational education effect is created. More importantly, this evidence raises the possibility of family-based interventions to reduce subsequent crime. The success of such programmes is reviewed in Section 3.2.

2.2 Confounding factors and other sources of bias

An individual may engage in crime for any one of a number of unobservable reasons. These may be related to the individual's patience, risk aversion, capability in criminal activities or pleasure gained from crime. Consider individuals with such unobservable characteristics that lead them towards crime. If schooling does not increase the return to crime for such crime-prone individuals, then they are likely to engage in less schooling. Thus, even without any actual causal effect of education on crime, the two will be negatively associated in data. This result would also follow if crime-prone individuals had low patience for school or found school particularly unpleasant.

It is clearly, therefore, important to deal with the bias resulting from unobservable factors. One way of doing this is to proxy such factors with measures that are observed. This can have important results. For example, in a meta-analysis of the evidence on the link between educational problems in adolescents and delinquency, defined as self-reported or officially recorded adolescent criminality, Maguin and Loeber (1996) find in bivariate analysis that those with low educational attainment are more than twice as likely

[2] Moffitt (1987) investigated the criminal records of 5,659 Danish male adoptees and of their biological parents and found no evidence of a genetic link.

as those with high attainment to be delinquent. This is on the basis of 145 cross-sectional studies. However, when the studies conduct multivariate analysis controlling specifically for intelligence, the educational attainment-delinquent effect is removed. Intelligence is, in other words, a crucial confounding factor. However, to a certain extent intelligence is an outcome of education and so this result does not indicate that there is no benefit to such investments. Rather, it points to the difficulties in establishing which variables are to be used to measure the educational investments received and which to proxy for unobserved confounding factors. We must turn to theory to answer this question.

2.2.1 Developmental versus econometric approaches

Because of these complexities, this report focuses firstly on those studies which have attempted more sophisticated approaches to the problem of establishing causality. These are described in more detail below. However, these more causal approaches are drawn from the econometric literature which takes a less general perspective than that from developmental criminology as described by Sampson and Laub (1993) for example. The developmental approach is concerned less with single causes than with the role of groups of risk factors. For example, Farrington (1990 and 1993) argues that the primary indicators of offending are:

- socio-economic deprivation, e.g. poor housing, low parental education, large family etc.;
- poor parenting;
- delinquency in other family member(s);
- school problems;
- manifested psychological problems such as hyperactivity or attention deficit.

The educational attainments of parents and children, therefore, partly determine the risk of criminality and partly mediate the effects of other risk factors.

In addition, there are clearly a great number of interactions between these different risk factors but the developmental perspective is not concerned to establish which risk factor is key. This approach does not 'solve' the problem of causality but rather establishes the common factors that must be taken into account by any policy. A successful policy can cause effects on all risk factors as well as on the desired outcome without ever clarifying the precise causal mechanism.

The focus on effectiveness is very useful for policy makers and the developmental perspective has been extremely influential in recent UK policy reviews. It underlies, for example, the recent Home Office review on research evidence (Nuttall et al., 1998), which emphasises the importance of multiple interventions:

> *"It is now accepted that to be effective, prevention programmes need to comprise a range of complementary measures which target multiple risk factors within the primary domains of a child's life."*

and

> *"children exposed to multiple risks and those who engage in anti-social or criminal behaviour at any early age are more likely to end up as serious or persistent offenders."*

This multi-dimensional approach has the virtue of recognising the inherent complexity of the determination of crime and of approaches to crime prevention. However, it does not lead to the estimation of effect parameters. This is partly because many influential studies have been conducted on small samples in which multivariate analysis is impossible and partly because the emphasis has been on clarifying ideas, rather than estimating effects.

However, another useful aspect of this approach is the concern with the developmental aspects of the careers of criminals. Particularly important is the idea of the professional, persistent or chronic offender. The previous Home Secretary referred in January (2001) to the 100,000 offenders who account for half of all crime[3]. This is similar in nature to the important distinction between adolescent limited and life-course persistent offending (Moffitt, 1993) and leads to the implication that if education could reduce the criminality of chronic offenders then this would have considerable leverage on the overall reduction of the cost of crime. This would not just be through reducing their own criminal activities but also of those they influence including peers and their children.

However, it may be that these individuals are particularly hard to influence through preventative educational rather than psychological interventions and that the schooling system is not currently designed to reduce chronic offending. Rather, it may be that education is better targeted at the 50% of crime that is not committed by chronic offenders but which schooling interventions are likely to have an impact upon. Section 3.2 describes the available evidence for these two possibilities which, sadly, is not yet sufficient to derive costed benefits of schooling based on this developmental model.

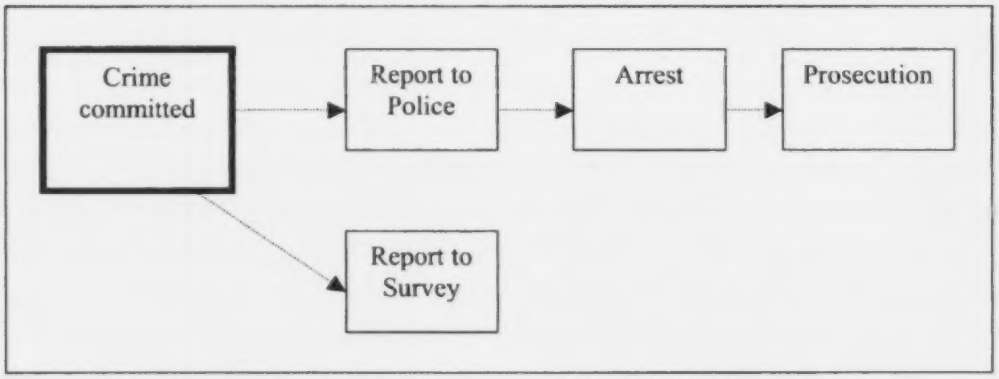
2.2.2 The measurement of crime

It is also important to recognise that quantitative crime research is never based on the observation of actual crime. As Figure 2 makes clear, there are many stages between a crime taking place and recording of the data. At each stage, measurement error at best but

[3] This evidence comes from Offenders' Index Data. This number is equivalent to 6% of all individuals or 18% of all offenders. Home Office (1995).

more likely bias is introduced. For example, data based on reports to the Police misses all unreported crime. Studies of the determinants of crime based on the characteristics of those arrested suffers from the bias that certain groups may be particularly targeted by the police or more likely to be caught. Other, similar biases may be introduced into studies based on those in prison or those who self-report crime. This caveat is important but it should be remembered that all the kinds of data described do contain valuable information that can be analysed and made useful provided appropriate care is taken.

Figure 2: The stages of crime data collection



3. The links: evidence-based benefits of the effects on crime

As discussed in Section 3, there is a considerable body of evidence about the association of education and crime. For example, Graham and Bowling (1995), have found that those who truanted from school were more than three times as likely to offend. It is relatively well known and not surprising that there is such a relationship. The econometric problem however, is only firstly to establish a connection, secondly and less trivially, it is to establish the extent to which the association represents a one-way effect and thirdly to attempt to quantify the strength of the connection. Consideration is given first to the econometric evidence that focuses on the income effect (effect (i), p.7) or time preference effect (effect (ii) p.7). The report then turns to experimental evidence and developmental approaches.

3.1 Econometric evidence

The best evidence for a robust effect of education on crime is provided by Lochner and Moretti (2001) (henceforth LM). This paper has a number of strengths described below

but is based on US data. The best UK evidence for an effect on crime comes from Machin & Meghir (2000) (henceforth MM) but describes the effect of wages not of education per se. However, both papers develop clear theoretical foundations that support their estimation procedures and both papers go beyond simple Ordinary Least Squares (OLS) analysis to estimate causal relations. LM attempt Instrumental Variables (IV) estimation to test the robustness of the causal link. MM use a fixed effect model to difference out time invariant confounding factors.

The LM paper is extremely useful in establishing a causal link between education and crime and in costing the implications. The paper also attempts a number of robustness checks that make the findings particularly important. However, since the paper is based on US data, the results are not quantitatively transferable to the UK. The following factors are qualitatively similar between the two countries but can be expected to diverge quantitatively such that empirical results would differ substantially:

- the relation between schooling and the labour market. The importance in the labour market of high school graduation is mirrored qualitatively in the UK case in terms of age 16 qualifications but not quantitatively;
- the returns to crime;
- the probability of arrest;
- the punishment tariff disincentive.

There are also significant cultural and sociological factors relevant to the determination of crime that can be expected to differ substantially. This report therefore, will not exploit the findings of the LM paper for precise cost implications. The paper is nonetheless relevant and important and is described here to provide robust, empirical evidence in support of the hypothesis of an education-crime link. This report does, however, derive cost implications from the MM paper.

This summary will describe the findings of these two important papers in some detail. Readers impatient for the key implications are invited to jump to the sections on cost implications.

Both papers develop a standard model of economic decision-making to enable a consideration of the effects on crime. Individuals choose to engage in crime where the returns to crime, subject to the risk of punishment, outweigh the returns to legitimate activity. This model of rational choice is standard in economics and ignores the effect of changes in preferences for crime. Such preferences are likely to be important but are unobservable in most data sets. The advantage of the economic approach is that it enables one to consider the effect of what is observed within a coherent framework that significantly reduces the possibility of substantive bias due to the effect of unobservable factors.

Both papers use their structural models of decision-making to support an empirical investigation of the observed determinants of crime. Whereas LM focus on education, MM concentrate on wages. However, to the extent that the UK relation between education and wages is known, it is possible to model the implied relation between education and crime, disregarding general equilibrium effects and under further assumptions about causality and the nature of the wage-education relation described below. One further advantage of the LM paper is that they cost the effect of education on crime. MM do not.

3.1.1 Lochner & Moretti

3.1.1.1 Theoretical background

In their theoretical model LM allow for the possibility that schooling might increase patience, thus increasing the anticipated cost of future punishments to criminal activity and so reducing crime. However, to make the model empirically tractable, LM restrict this possibility, making the assumption that schooling does not effect patience. The estimated relation, therefore, is the effect of education on crime through the effect on wages. To the extent that schooling also affects patience and so reduces crime, the estimate will be an over-estimate of the indirect, wage effect of education on crime. More strictly, the estimated relation is the effect on crime of the difference in wage returns to schooling and the crime returns. LM assume that this difference is linear in schooling, i.e. that schooling increases the difference in returns by the same amount at all levels of schooling.

3.1.1.2 Data and variables

LM investigate the effect of high school graduation on incarceration using US Census data from 1960, 1970 and 1980. The data is at the individual level but the results control for state and time. The time effects control for general trends in incarceration. The state effects reflect differences between states in the probability of punishment and the nature of punishment, i.e. the disincentive effect. They also report estimates controlling for age, state of birth, state of residence and cohort of birth. These take account of the fact, for example, that older males are less likely to have completed high school and less likely to be incarcerated, resulting in a downward bias on the estimated dropout effect on the probability of incarceration.

Unobserved personal characteristics that increase the return to crime are likely to be negatively correlated with schooling since those with high criminal returns have less incentive to stay in school. This will mean that the effect of dropping out on crime estimated by regression analysis may be biased upwards, i.e. an over-estimate. LM, therefore, use IV estimation based on instruments that are exogenously related to

schooling but unrelated to crime. These are state-level changes in the minimum school leaving age. Since these are correlated with schooling but not with crime, they are valid instruments and enable LM to find the exogenous effect of schooling on crime.

LM recognise incarceration is only a proxy measure of actual crime based on the links in Figure 2 (p. 12). If the rate of arrest or of incarceration subject to arrest vary with education, then a study based on incarceration data will give biased results. However, LM report findings that the difference in sentencing by dropout status is only of the order of 2% - 3%, suggesting that the effect of dropout on arrest should be similar to that on incarceration. They also use self-reported crime evidence to argue that the effect of high school graduation on criminal activity is similar to that on arrest and incarceration. In other words, that the stages of the chain in Figure 2 do not introduce bias into their findings. Bias resulting from the effect of education on the probability of incarceration subject to arrest or arrest subject to criminal activity is minor.

In order to consider the effects of education on particular types of crime, LM also turn to state-level FBI data. They analyse the effect of the state-level dropout rate on the arrest rate for particular crime types, controlling for unobserved factors through the use of state, year, cohort and offence type dummy variables. They show that although the arrest per crime rate is much higher for serious crime than for less serious crime, the correlation between state-level arrests and crimes is extremely high (above 0.95 for most crime types). This suggests that state-level variation in arrests is a good proxy for state-level variation in crimes.

3.1.1.3 Results

LM find that once year, age and state of birth effects are included in the specification, high school drop-out increases the probability of incarceration by 0.72 - 0.78 percentage points for white males and 3.2 - 3.6 percentage points for black males[4]. These results are from OLS regression analysis but LM find that IV results are quantitatively similar.

Table 1 shows the effect of dropout on particular crime types resulting from LM's analysis of state-level FBI data. For example, based on a 90% confidence interval, a 10 percentage point rise in the graduation rate would cut the murder arrest rate by 14 and 27% (the point estimate of 21% is shown in Table 1). The strongest effects are on murder, assault and vehicle crime. The effects on murder and assault mitigate against an interpretation of an income effect to the extent that, as MM argue (see below), violent crime is less well explained by economic incentives than other forms of crime. To some extent this suggests that the schooling variable is picking up effects of peer groups and life-styles resulting from the non-completion of high school rather than the direct effect

[4] As elsewhere in this report, a 90% confidence interval is reported. The point estimates are 0.75 and 3, 4 respectively, the standard errors are 0.02 and 0.11

of the missed learning. The result is also compatible, however, with the hypothesis that the effect of schooling is through increasing the opportunity cost of prison sentences since these are particularly high for violent crimes.

The authors tentatively suggest that the apparent positive effect of high school graduation on rape may occur because less educated women are less likely to put forward rape charges.

Table 1: Effect of a 1 percentage point increase in the state-level high school completion rate on the arrest rate (% effect) and resulting social benefit

	Estimated effect (1)		Social cost per crime, $000 (2)	Social benefit, $ million (3)	
	%	s.e.		Lower	Upper
Murder	-2.1	0.4	3,024	777.5	1481.7
Rape	1.0	0.4	89	-216.3	-61.9
Robbery	0.1	0.3	9	-50.4	33.2
Assault	-2.2	0.3	10	277.4	459.2
Burglary	-0.3	0.3	1	-12.0	30.6
Larceny	-0.3	0.3	0.2	-5.9	19.7
Vehicle	-1.3	0.3	1	9.7	25.7
Arson	-7.8	0.4	39	2.6	34.0

Note: Results indicate the percentage effect (relative effect, not percentage point effect) on the crime rate of a 1 percentage point fall in the dropout rate.
Column (1): LM, Table 10. Results from OLS regressions controlling for effects of age x offence, offence x year, age x year, state x age, state x offence and state x year.
Column (2): LM, Table 13, based on victim costs (including property loss) and incarceration loss.
Column (3): Based on 90% confidence interval.

3.1.1.4 Cost implications

It is important to note that the study focuses on the effect on crime of educational failure. LM note that the raw incarceration rate for all males in the 1980 Census was 0.4% for high school graduates but 1.5% for drop-outs, i.e. nearly 4 times higher. For black, male high school drop-outs the incarceration rate was 4.1% as opposed to 2% for black, male high school graduates. This jump is substantially greater than that associated with any other failed schooling progression. For example, the increase in crime associated with failing to move from 11 to 12 years of school (graduating from high school) is 3 times larger than that associated with failing to move from 10 to 11 years. This suggests something analogous to a sheepskin effect for crime, i.e. that the effect of schooling on crime is not linear but related to receipt or otherwise of key diplomas.

To convert the estimates to social costs it is necessary to weight the figures by the current arrest rates for each crime type and weight up to deal with the attenuation resulting from deviation of the arrest rate from the crime rate. This gives an estimated change in crime numbers resulting from a 1 percentage point increase in the drop out rate. Based on US crime and arrest rates LM estimates give a reduction in crime of between 94,310 offences, with a social benefit of $1.4 billion. However, this includes effects that are not precisely estimated and statistically insignificant. Therefore, put in terms of a 90% confidence interval this represents a reduction in crime of between -14,000 and 225,000 offences[5] with a social benefit of between $0.8 billion and $2.0 billion.

If one rejects estimated effects on crime types that are not statistically significant at 90%, i.e. those on robbery, burglary and larceny/theft, the reduction in crime is between 34,000 and 68,000 offences with a social benefit of between $0.9 billion and $1.9 billion. Roughly 80% of this effect is caused by effects on murder, which is more prevalent in the US than UK so the effects are clearly not directly transferable. They are, however, indicative.

Furthermore, the strong effect on violent as opposed to property crime runs slightly counter to their model since one might expect educational effects through wages to be more likely in property crime. However, if failure to graduate from high school puts you into poor peer groups (gangs) then, in the US, the big effect may be expected on violent crime. This is IV analysis where graduation is instrumented by state level changes in minimum leaving age legislation and the results condition for state and time effects plus interactions but it does not follow that all of the effect of non-graduation is through the wage.

These social benefit figures include victim costs (productivity and wage costs, medical costs and quality of life costs based on jury awards in civil actions) and property loss figures from Miller et al. (1996) and incarceration costs from Stephen (1999). They are therefore, under-estimates since they omit some aspects of the costs of crime such as private security measures, law enforcement and judicial costs. They also omit some kinds of crime, notably drug related crime, which cost over $5 billion in terms of incarceration alone in 1991 (Lynch et al., 1984).

The LM results translate to an annual social benefit of $1,170-$2,100 per additional male high school graduate (depending on which estimates are used), 14% - 26% of the private benefit and comparing to a one-off direct cost of $6,000.

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[5] The estimated effect on numbers of crimes is given in LM, Table 13, column 6. These are re-evaluated for coefficients two standard errors either side of the LM point estimates to give unreported 90% confidence interval limits for the change in numbers of offences for each crime type. The re-aggregated figure is reported in the text above.

3.1.2 Machin & Meghir

3.1.2.1 Theoretical background

The rational model of crime determination is applied by MM to property crime only and not to violent crime, which the authors believe may be less well explained by economic incentives.

In the rational model of crime determination, education pushes up the returns to legitimate activity and so reduces the likelihood of individuals engaging in crime. MM argue that it is more sensible to analyse the effects of wages on crime than of unemployment on crime because many individuals engage in both work and crime. Wages, therefore, better reflect the incentives available in the labour market. Against this it might be argued that time spent in legitimate labour market activity is not really traded off against time spent in crime since most crimes do not take long to plan or execute and can in any case be committed outside working hours! Nonetheless, it might still be argued that the opportunity cost of crime includes the risk of punishment and since this rises with the wage, higher wages will reduce crime.

3.1.2.2 Data, variables and method

The MM study is based on area level crime data for the 43 police force areas of England and Wales (excluding the City of London), 1975-1996. This is matched to earnings data from the New Earnings Survey. In order to estimate the effect of the right wage signal on the decisions of labour market participants and those potentially engaged in crime, MM look at the effect of the 25th percentile of the wage distribution on crime. This is considered to be the closest single measure of the possible wages available to those choosing between different combinations of crime and legitimate work. Experiments with other measures of the wage distribution or of the distribution of wages available to workers in particular sectors demonstrate that the results do not depend excessively on the measure chosen.

In their regression analysis, MM control for the proportion of young people in the population, a measure of the conviction rate and include area and year fixed effects. This fixed effects method means that the resulting coefficients can be seen as assessing the effect of a change in wages in a particular area and year on the change in the level of crime in that area. In addition, the analysis controls for the changing likelihood of conviction and the changing proportion of young people in the population. Further experiments control for the lagged value of the crime rate, to control for peer group effects and to deal with the negative, reverse causality that if crime rates go up *ceteris paribus* conviction rates fall. IV is also used as an alternative method for dealing with this problem.

It should be emphasised that there are many advantages to this fixed effects method in which estimation is based on the effects of the change in wages on the change in crime. It means, in particular, that it is substantially less likely that the wage effect erroneously picks up other factors that are correlated with the wage and with crime such as neighbourhood deprivation, family breakdown and other associated cultural and demographic factors. Essentially, this method removes the effect of any variables that are constant year on year. The wage moves in tandem with the business cycle but the cultural factors mentioned move much more slowly and the correlation between the change in any of these cultural variables and the change in the wage is much less than the correlation between the level values. The bias of confounding factors is therefore substantially reduced.

3.1.2.3 Results

In their preferred specification, MM find that a 10% higher 25th percentile area wage rate reduces the overall area property crime rate by 0.8 percentage points[6]. In all specifications, this marginal effect varies between 0.7 and 1.0 percentage points. Using the 25th percentile wage for retail trade workers as the wage variable produces slightly lower results (down to 0.6 percentage points) but this is not a better specification in that the alternative wage variables represent the incentives available for a smaller proportion of the population. This result does, however, indicate that the key findings are robust to the choice of wage variable. MM also develop a specification to take account of the effect of compositional changes in the labour force on the results. These estimates provide a lower bound for the wage effect on crime of 0.4 percentage points. These estimates are not preferred since they rest on the extreme assumption that all non-workers have lower wage rates than those working and are intended as robustness checks.

Breaking overall property crime rates down into the sub-categories of property crime, the point estimate effects are as shown in Table 2. A 10% increase in the 25th percentile wage will reduce the vehicle crime rate by 4.8 percentage points, the theft and handling rate by 0.4 and the burglary rate by 0.18. All effects are strongly statistically significant.

[6] This is based on a co-efficient of -1.506 in a logistic model. A 90% confidence interval gives a range of [1.24, 1.77]. Using information on average property crime rate convictions supplied by Steve Gibbons and gratefully received, it can be reported that this transforms to a marginal effect range between 0.67 and 0.95 points.

Table 2. Marginal effect of a 10% increase in the 25th percentile wage on the crime rate, percentage points

	All property crime	Vehicle crime	Theft and handling	Burglary
Effect	-0.81	-0.48	-0.40	-0.18

Source: MM.
Note: see Table 3 (p.22) for confidence interval for effect on 'all property crime'.

3.1.2.4 Cost implications

As with LM, MM focus on the effect on crime of educational failure. MM choose the 25th percentile of the wage distribution as their measure of the wage incentive facing potential criminals because they consider the low end of the wage distribution to be the relevant signal. Although they do not observe the educational level of potential criminals, they assume that it is low and so the wage possibilities of legitimate work for potential criminals are also low. In fact, MM get quantitatively similar results with the 10th percentile, suggesting that the incentive effect of wages on crime is indeed felt at the low end of the joint distribution of wages, education and skills.

Consider now the conversion of these estimates into the social benefit of the effect of wages on crime. The first issue is the implication of the MM estimates for the numbers of crimes committed in each of the categories. Since the MM estimation gives the average effect of a change in the wage distribution on the recorded crime rate between 1975 and 1997, consider the benefit in terms of the average numbers of crime committed over that period. The first step, shown in column (1) of Table 3, is to show the average number of crimes in each of the MM categories[7]. The reduction in crime resulting from the effect of a 10% rise in the 25th percentile of the wage distribution is shown in column (2). These are then factored up in column (3) to take account of the fact that many crimes go unreported. These multiplying factors differ by type of crime and are described in the notes to the table. For example, it can be seen that a 10% increase in the 25th percentile wage would reduce the number of recorded property crimes by over 400,000. Using the weighted multipliers derived by Brand and Price, the reduction in actual property crimes is estimated to be over three times larger at over 1,300,000[8].

[7] Note that total property crime on the MM definition excludes criminal damage, fraud and forgery, which between them account for 31% of recorded property crime in the official definition. Theft and handling includes the sub-category of vehicle crime. Other definitions are given in the notes to Table 3.

[8] Brand & Price (2000) give multipliers for each of the official sub-categories of crime. The sub-categories are factored up by their crime-specific multiplier and then calculated to a total property crime multiplier of 3.25.

Column (4) then gives the estimated cost of each incident based on the Home Office Research Survey (Brand and Price, 2000), which estimates that the total cost of crime in England and Wales in 1999/2000 was £60 billion. It is worth pointing out that that study was not able to estimate the cost effects of the fear of crime, the effect on victims' families or inter-generational effects. Included costs are those due to the anticipation of crime (security and insurance administration), as a consequence of criminal activity (loss/damage to property, emotional and physical impact) and in costs to the criminal justice system. Of the £60 billion annual cost, burglary accounts for 8%, vehicle crime, 7% and non-vehicle theft and handling, 7%. Thus total property crime in the MM definition, i.e. excluding fraud and forgery and criminal damage, accounts for 22% of the total cost of crime. What the overall benefits of education would be if all kinds of crime responded to wage changes in the way estimated by MM is considered below.

Based on the Brand and Price figures the overall effect of the change in the wage distribution is given in column (5) and would be between £1.3 billion and £1.8 billion in an average year over the period. This is an under-estimate of the total crime effect since it only includes effects on property crime and only on the costs estimated by Brand and Price.

Table 3. Property crime rates for England and Wales and social benefits from increased wages.

	Recorded crime, 1975-1997, average (1)		Effect of 10% increase in wage measure on recorded crime (2)		Estimated effect on actual crime (3)	Estimated social cost per average incident (4)	Estimated social benefit (5)
	Total	Rate, %	% point	No.			
Burglary	878,130	1.74	-0.18	90,852	238,939	£2,466	£589.2m
Theft and handling	1,984,904	3.93	-0.40	242,271	830,988	£1,220	£957.6m
Total vehicle	973,878	1.93	-0.48	201,892	561,260	£1,400	£881.9m
Total Property Crime:	2,888,321	5.72					
Lower bound			-0.64	338,170	1,099,051	£1,181	£1,298.0m
Upper bound			-0.98	479,494	1,558,356	£1,181	£1,840.4m

Note: Definitions and proportions from criminal statistics given in Home Office (2001): Burglary, in dwelling (49%), out of dwelling (51%); Vehicle crime, theft of vehicle (33%), from vehicle (61%), vehicle interference (3%); Theft and handling, from person (4%), of cycle (5%), from shop (14%), vehicle crime (45%), other (29%); Total property crime; burglary (30%), vehicle crime (35%), Theft and handling excluding vehicle crime (34%).

Column (1): Criminal Statistics (ibid). Rates based on average England & Wales population 1975 - 1997 of 50,473,060, National Statistics.

Column (2): MM, Table 2.

Column (3): Figures from Column (1) weighted by difference between recorded crime and crime estimated in British Crime Survey (BCS), Commercial Victimisation Survey or estimated. Source: Table 2.2. Sam Brand and Richard Price (2000). Multipliers used here are weighted for the difference in sub-categories of recorded crime. This takes account of the fact, for example, that whereas the multiplier for thefts of vehicles is only 1.2, that for thefts from vehicles is 3.9. The resulting weighted multipliers are: burglary, 2.63; vehicle crime, 3.12; Theft and handling, 3.24; Total property, 3.25.

Column (4): Table 2 Brand and Price (2000). Figures for estimated social costs are weighted by the prevalence of the sub-categories in each of the classes of crime described. For example, in the case of burglary, the social cost per in-dwelling incident is £2,300, that per not-in-dwelling incident is £2,700. The figure of £2,507 is derived as the weighted average of the two figures where the weights are the proportions of each kind of burglary in the estimated total number of actual burglaries. This is particularly important for theft and handling where the cost per theft of commercial vehicle is £9,700 but that for theft from a shop is £100. Note, it is assumed that theft of commercial and private vehicles are equally prevalent. Further, the weighting of vehicle crime to theft and handling is based on their relative contributions to the level of crime after the wage intervention. This is necessary because vehicle crime is particularly responsive to the wage change. Weighting in this way avoids the anomaly that, although vehicle crime is a sub-component of theft and handling, the overall benefit of the effect on vehicle crime exceeds that of theft and handling.

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Now factor in the effect of education on the wage based on estimates of the relation between area (county) education levels and area wages from the 2000 Labour Force Survey. Conditions are made for the area age distribution and industrial structure since in the short-run this is given regardless of the effect of any additional educational achievement.

The full regression results are shown in Appendix 1, and demonstrate how county-level wages vary with the proportion of an area with different highest academic and vocational qualifications. The tables in Appendix 1 show the results under a number of different specifications, based on different sub-samples and for different academic and vocational training effects but the results in column 1 of Appendix 1 are most pertinent to the current costing exercise. They show the effects of a change in the proportion with qualifications at different levels on the log of the 25th percentile of the wage for all workers, the wage distribution variable used by MM. This leads to an estimate of the elasticity of wages with respect to academic and vocational qualifications[9]. This can then be linked to the MM estimate of the elasticity of crime with respect to wages to give a figure for the responsiveness of crime with respect to qualifications. The key coefficients are shown in Table 4 (p. 25).

Disregarding for a moment the important assumptions required, interpretation is as follows: The coefficient for the proportion with A Levels ranges with 90% confidence between 0.63 and 2.65. Taking the lower limit, this means that if the proportion of the population with A Levels rises by 0.1, the log of the 25th percentile of the hourly wage will rise by between 0.063, an increase in the 25th percentile of 6.3%. This suggests that a 10% increase in the 25th percentile would require an increase in the proportion with degrees of 0.16, at the lower limit. As column 2 indicates, the implication is that a 16 percentage point increase in the proportion of the population with degrees would increase the 25th percentile of the wage distribution by 10%, reduce total property crime by 0.8 percentage points and produce £1.3 billion of savings in wider benefits of learning, at the lower limit MM estimate. Columns 3 and 4 show the savings in terms of the costs of property crime of 1 and 5 percentage point increases in educational levels.

At the lower end of confidence limits, a 1 point increase in the proportion with A Levels is predicted to create benefits of £80 million in reduced property crime. At the upper end of the confidence limits, the benefit would be £500 million. The range is large because two sets of confidence limits have been factored in, those of roughly 20% around the MM estimated crime saving and margins of error of between 24% and 53% around the education effect coefficients, disregarding the limit on 'under O Level' effect. The combination makes for a large degree of imprecision.

[9] See Appendix 3 for a precise description of education and training classifications used.

It is important to note that the education variables are the proportion in the county with the highest qualification as specified. The specified effects in Columns 3 and 4, therefore, are based on a *ceteris paribus* assumption. For example, consider the increase in degree proportion described above. In order for the full effect to be gained it is necessary to assume that all the new degree holders had moved from the no qualifications category. If the new degrees had come from the A Level category then just as the degree proportion goes up producing the described effect, so the A Level proportion goes down, producing an offsetting effect unless there is also the appropriate increase in the proportion moving from O Level to A Level and from no qualifications to O Level.

Note, too, that the main effects come from higher level qualifications and that negligible, insignificant but wrong-signed changes in the wage distribution are brought about by increases in the proportions with below O-Level qualifications. The implication is that, although it is those with low qualifications who are thought to be most influenced by the crime/work trade-off, small increases in human capital are unlikely to be sufficient to induce much effect on that choice.

Effects of increases below O Level are trivial but it is estimated that a 5 percentage point increase in the proportion of the area population with O Level or equivalent qualifications will produce a reduction in crime with a benefit of up to £1.6 billion per year. In these data, 23% are without O Level or equivalent so the associated policy choice is to reduce that figure to 18%.

Table 4: Relation between area-level education and the log of the 25th percentile of the wage, England & Wales, 2000, implications for social benefits.

	Estimated coefficients of the effect of educational level on wages (1)		**Percentage point increase in qualifications required for a 10% increase in 25th percentile (2)**		**Implied saving from an increase in the proportion with education level, £ million: 1 point (3)**		**5 points (4)**	
	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper
Degree	0.959	2.427	10.4	4.1	118.9	460.8	594.4	2,304.1
A Level	0.633	2.649	15.8	3.8	78.5	502.9	392.3	2,514.7
O Level	0.105	1.673	95.0	6.0	13.0	317.6	65.2	1,587.9
Under O Level	-0.796	0.388	-12.6	25.7	-98.7	73.7	-493.7	368.6

Note: Those with no qualifications are the default group. Education variables are the proportion in each county with highest qualification as specified, see Appendix 3 for more information. To achieve the specified effects, therefore, it is necessary to assume that all new members of the category have moved from the no qualifications group or that offsetting increases have been established all down the line.
Column (1): Lower and upper bounds are based on 90% confidence limits from regression in column 1 of Appendix 1, a regression of county level wages on education, age structure and industry structure, 2000. See Appendix 1 for full details.
Column (2): This is calculated as 10 x reciprocal of coefficient from column 1. This gives the change in the proportion with qualifications required for a 10% increase in the 25th percentile of the wage, with resulting £1.3 - £1.8 billion estimated saving.
Column (3): Lower limit based on lower limit of education effect in column 2 and lower limit of crime effect from Table 3, i.e. calculated as £1.3 billion / lower limit in column 2. Upper limit based on upper limits in both cases, i.e. £1.8 billion / upper limit in column 2.
Column (4): This is calculated as 5 x column 3.

The assumptions underlying these conclusions are described shortly. Accepting the uncertainty in the exercise and the inherently ad hoc nature of decisions about confidence interval limits, the results in Table 4 represent an informed guess at the social benefits of education in reducing property crime, through the wage channel. Thus:

- The benefit from a 1 point increase in the proportion of the working age area population with O Level or equivalent qualifications, is predicted to lie between £10 million and £320 million.
- The benefit if 1 percentage point of those in the area population with O Levels,

reached A Level or equivalent qualifications and those with O Levels or equivalent who progressed were replaced by those who had previously had no qualifications, is predicted to lie between £80 million and £500 million.

3.1.2.5 Assumptions

Underlying these results is the assumption that the estimation procedure has accurately identified 'effects'. It has been assumed that there are no confounding factors picked up by the education variables but in these simple models that is not a trivial assumption. For example, it may be that areas with high levels of qualifications also have infrastructures and cultures that are supportive of the creation of high returns to qualifications. Increasing the level of education in Merseyside to that in Hertfordshire is unlikely by itself to create the same returns to education unless the possibilities of the London labour market were made equally available. Thus, although controls are given for the industrial structure[10] and age structure of the county, it is likely that there are a number of confounding factors that bias the estimate of the education elasticity.

This bias could go either way. It may be that interventions to increase education in the way described will not have the predicted effect because low education county populations have worse risk factors than those with high education levels. Or, again, it may be that the returns to educational interventions are higher at the bottom end.

Similarly, it is also assumed that effects are linear i.e., the effect of a 10 percentage point increase is 10 times greater than the effect of a 1 point increase. This is a strong assumption and it may be expected that as increases in the numbers with qualifications get larger, the wage benefits will decline because of over-skilling and because less productive individuals are being educated. Against this, however, one might point to the fact that the returns to education are higher for those with less education. Increasing education at the county level might initiate a virtuous circle of positive externalities in terms of skills, enterprise, job creation, investment and growth that make the estimated elasticity an under-estimate in the long-run. It is also assumed that there are no general equilibrium effects. This is similar to the previous point.

Finally, it is pointed out that a more rounded study would consider the relation between qualifications and wages over the period 1975-1997 since that is the period over which the crime effects of wages were estimated. However, that would require a very substantial coding exercise in the Labour Force Survey (LFS) and would require considerably longer than is possible for this report. Further error is nonetheless introduced by this simplification.

[10] Industrial structure coefficients are not reported.

3.1.2.6 Conclusions

Based on the analysis described above, there is clear evidence of substantial wider benefits of learning through wage effects on the reduction of crime. The channel is the incentives available to those choosing between crime and legitimate labour market activity and the inhibitive effect of time out of the labour market if caught. Evidence comes from the relation between year on year changes in wages in each area on the change in area crime rate. The suggestion is that there are substantial savings to be made. Taking 1% of the working age population from no qualifications or low qualifications to the achievement of 1 O Level would reduce the costs of property crime by between £10 million and £320 million per year. If those same people were taken to A Level or equivalent, the saving would be between £80 million and £500 million.

Given the importance of the young in committing crime, it would be interesting to see how these results change if analysis focuses solely on the wages of youth and young males in particular. That analysis is beyond the scope of this report but Appendices 1 and 2 report results of wage regressions for males and young males. It can be seen, for example that the wage effects of education for male workers (column 2, Appendix 2) are much stronger than the effects reported above. One would need to know the responsiveness of male crime to male wages to know precisely what this implied for the education-crime link but subsequent work could profitably focus on this issue.

To now return to the Brand and Price (2000) estimate that the total cost of crime in England and Wales in 1999/2000 was £60 billion of which total property crime contributed 22%. The MM estimates suggest that if all crime was as responsive to wage changes as property crime, the effects would be nearly 3 times as large, an actual ratio of 2.7. Factoring up the results of Table 4 would produce even larger benefits but would require the assumption that the effects are equal for all forms of crime. This may not be so strong an assumption if LM are right that educational failure has an even stronger effect on violent crime than on property crime. However, we are not in a position to test this assumption for the UK. It should also be noted, that even the £60 billion total cost estimated by Brand and Price excludes drug trafficking and possession, handling stolen goods, public order offences, low level disorder, fare evasion and motoring offences. They also exclude the wider effects of crime such as economic distortions.

3.2 Chronic offenders and the developmental perspective

An alternative to the econometric approach to costing the wider benefits of learning comes from the developmental tradition, as represented in the arena of crime by the work of David Farrington and John Laub. As stated above, a key finding of this literature is that in the UK there are 100,000 offenders who account for half of all crime. If education could affect the incidence of crime by this group, then the overall cost of crime would be

substantially reduced. Against this, however, is the idea that these offenders are particularly insensitive to education interventions and that policy would be better targeted on the rest of the population who commit the other 50% of crime.

Unfortunately, there is as yet no hard evidence about the relative effectiveness of mainstream educational interventions on these two groups. Blumstein et al. (1985) consider recidivism probabilities and find a significant demarcation between those with 6 or more arrests by age 18 and those with fewer than 6. In other words, the former group represent the 'chronic persisters' who have high recidivism rates while those with more than 3 arrests can be thought of as 'mild persisters', for whom recidivism is more likely than for non-offenders but less likely than for chronic persisters. However, the key distinction between chronic and mild offenders is the age of first conviction which is not an obvious policy variable and there is no evidence in the paper about the relative levels of educational failure of the two groups.

In other evidence, Farrington (1999) makes a distinction between 'delinquents' with 1 or more offence, and 'persisters' with 3 or more convictions. Significant differences are observed between these two groups in terms of family income and social class, the level of involvement of the father, other delinquency in the family and concentration and troublemaking in school. For example, whereas 15% of non-offenders in the Cambridge Study were rated as troublesome by teachers, 29% of occasional offenders and 64% of persistent offenders were so rated. This shows a clear relation between troublemaking and both delinquency and the level of delinquency.

Unfortunately, although this evidence is useful in pointing to the ability of risk factors to indicate and predict persistent offending, there are no clear implications about the effectiveness of learning interventions. It is clear that school and schooling is important but the causal processes are extremely unclear. The recent Home Office report on Youth Crime (Flood-Page et al., 2000) finds that 12-16 year old boys (Youth Lifestyles Survey, 1998/9) who did not like school were 3 times more likely to offend (31%) than those who liked school (9%). 18 to 30 year olds were 4 times more likely to be persistent offenders than those with some qualifications. Unfortunately for the purposes of this analysis, the report does not give an equivalent figure for non-serious offenders, without which it is not possible to evaluate the relative importance of qualifications for persistent and non-persistent offenders. This is postponed to future research.

Moreover, without longitudinal data with sufficient wealth of information to observe changes in the degree of attachment to school claims about the causal pattern are in any case prone to substantial bias. Those with a tendency to commit crime are likely to have reduced attachment to school for any number of reasons. Although one may wish to draw the policy conclusion that increasing attachment to school will reduce crime, there is insufficient evidence to support this conclusion and, more importantly, there is no

indication about how to achieve it or what the relation is between the degree of change and the level of criminality.

3.2.1 Experimental studies, including pre-school and parenting programmes

As stated above, a key issue is the establishment of effects. An important and relevant body of evidence is provided by the literature on the evaluation of experimental studies of crime reduction since, under standard conditions, experiments can provide extremely robust evidence of effects. However, experiments are commonly conducted on small samples and it is important that results are replicated in order to be sure that one can generalise from results.

An equally important issue for policy is the scaling-up problem. It is *relatively* easy to create benefits in a small-scale intervention with high-quality, motivated and possible self-interested staff, much harder to recreate such success on a national scale with much greater variation in quality and more complex monitoring and dissemination requirements. Shadish et al. (2002) draw a distinction between 'efficacy trials' which evaluate small-scale interventions, often with much higher budgets than what is plausible for scaled up programmes and commonly find positive benefits and 'effectiveness trials', in which interventions are tested in more realistic contexts. Unfortunately, the former are far more common and are referred to more often in presentation of the experimental evidence. This is true also for the evaluation evidence of programmes to reduce crime.

Table 5 (p. 30) is taken from the review of experimental evidence on delinquency prevention conducted by Farrington and Welsh (1999). This is efficacy evaluation in the sense described above but does indicate that well-funded and targeted programmes can be successful.

It is noted that all of these evaluations were based on randomised or matched trials, were peer-reviewed and had initial treatment samples of at least 50. Many of these programmes were successful but some were not and there is insufficient evidence on why this is so. Nonetheless, programmes based on home visiting, day care, pre-school, school-based, clinic and multi-systemic treatment have all been demonstrated to reduce criminality, anti-social behaviour and delinquency. For example, the Montreal Longitudinal Experimental Study identified 366 aggressive and/or hyperactive 6 year olds and initiated a programme of school-based training in social skills and self-control. Small group sessions worked on issues such as 'what to do when you're angry' and parents received training in consistency of child management. Statistically significant delinquency differences were recorded between control and treatment groups for every age between 10 and 15. The children were at risk of becoming offenders but their delinquency rates were nonetheless appreciably reduced.

Table 5: Summary of prevention programmes (Farrington & Welsh, 1999)

Author, location	Initial sample	Main intervention	Main results
Home visiting			
Olds and others (1998), Elmira (NY)	400 mothers	Parent education	Child arrests at 15(+)
Stone, Bendell and Field (1988), Miami	131 mothers	Parent education	Child behaviour problems at 5-8(0)
Day care			
Johnson and Walker (1987), Houston	458 children age 1	Parent education	Aggression at 8-11(+)
Lally, Mangione and Honig (1988), Syracuse (NY)	182 children age 0	Parent education	Delinquency at 15(+)
Preschool			
Schweinhard, Barnes and Weikhart (1993), Ypsilanti	123 children age 3	Skills training	Arrests at 27(+)
Pagani and others (1998), Montreal	404 boys age 4	Skills training	Delinquency at 12(+)
School			
Hawkings and others (1999), Seattle	643 children age 10	Parent/teacher training	Violence at 18(+)
Tremblay and others (1995), Montreal	319 boys age 6	Parent/skills training	Delinquency at 15(+)
Reid and others (1999), Oregon	671 children 7-11	Parent/skills training	Conduct problems at 11(+)
Kolvin and others (1981), Newcastle (UK)	592 children 7-12	Skills training	Delinquency at 12(+)
Clinic			
Webster-Stratton, Kolpacoff and Hollinsworth (1988), Seattle	114 children age 4	Parent training	Behaviour problems(+)
Webster-Stratton and Hammond (1997), Seattle	97 children age 5	Parent/skills training	Behaviour problems at 6(+)
Kazdin, Siegel and Bass (1992), Pittsburgh	97 children age 10	Parent/skills training	Conduct problems at 13(0)
Community			
McCord (1978), Boston	650 boys age 10	Counselling	Criminal behaviour at 45(-)
Dishion and others (1992), Eugene	119 children age 12	Parent/skills training	Behaviour problems at 13(0)
Harrell and others (1997), 5 US sites	671 youths age 12	Risk focused	Delinquency(0)
Multi-systemic			
Borduin and others (1995), Missouri	176 youths age 14	MST	Arrest at 18(+)
Schoenwald and others (1996), Charleston (SC)	118 youths age 15	MST	Time in institution at 16(+)
Henggeler and others (1997), 2 US sites	155 youths age 15	MST	Delinquency at 17(+)

Notes: (0) = No significant difference; (+) = desirable intervention effect; (-) = undesirable intervention effect; MST = multi-systemic therapy. Immediate follow-up unless otherwise stated. References are given in a separate section following main body of references at the end of this document (p. 37).

Another example of a school-age experimental design is the Quantum Opportunities Program (QOP), a US youth development program designed to serve disadvantaged adolescents by providing education, service, and development activities, as well as financial incentives, over a 4 year period, from 9th grade until high school graduation. An evaluation which compared QOP participants to a control group demonstrated that QOP members were both more likely to be high school graduates (63% of QOP members graduated high school compared to 42% of the control group) and less likely to be arrested (19% of QOP members compared to 23% of the control group). The economic return is estimated at 3.68 units per unit of monetary investment (Nuttall et al., 1998, Table 2.1).

Future work will be able consider the strength of this evidence and the size and range of effects but that has not been possible for this report. Furthermore, although these trials have demonstrated effects for children with a high risk of becoming persistent offenders as well as for more general populations, they have not distinguished the two groups. There is, therefore, as yet no available evidence to test the hypothesis of the relative benefits of programmes that target persistent offenders and those that target less persistent offenders.

3.2.2 Adult interventions and basic skills

As explained in the introduction, this report is concerned not just with the association of academic qualifications and crime but also with all aspects of learning through the life cycle. For example, Vennard et al. (1997) report meta-analytic results that programmes of cognitive-behavioural treatment with offenders reduces recidivism by 20 percentage points relative to control groups. The social benefits are likely to be considerable but this evidence also suggests that well-focused post-school learning interventions can reduce crime.

The Home Office report on Youth Crime (Flood-Page et al., 2000) described above, finds that disaffection with school is strongly linked to offending. Poor acquisition of the basic skills of literacy and numeracy often underlies the school problem. The British Government's Basic Skills Agency (BSA) has carried out surveys of different sections of the population including one involving 414 inmates in 16 prisons (BSA, 1994) and a major prison 'literacy screening' exercise involving 28,695 prisoners. These have involved assessments of functional literacy and numeracy, measured against national standards: Foundation; Level 1; Level 2; Level 3 for literacy, and Foundation; Level 1; Level 2 for numeracy[11]. The tests used require respondents to carry out every day tasks, such as extracting information from 'Yellow Pages' or working out change in a shop. The tasks are set at different levels of difficulty corresponding to the national standards.

[11] Broadly, Level 2 is the equivalent of the British GCSE, standard or O Level; Level 3 approaches the British A Level.

Overall scores are obtained from performance across all the tasks.

Overall the percentage of prisoners with poor basic skills as assessed by such tests was substantially higher than for other sections of the population. More prisoners had failed to achieve Level 1 (53%) – 3 times the proportions for adults generally and 10 times the proportion for college students. For numeracy these differences were not apparent. Much the same (high) proportion, one half prisoners, as in the adult population, had failed to achieve level 1 numeracy – about 3 times the proportion in the college sample. In the more recent 1997 screening exercise the prevalence of poor literacy skills in prisons was lower but was still substantially above that of the adult population.

An intervention in Canada attempted to break the link between poor basic skills and offending directly in the prison setting. Porporino and Robinson (1992) investigated the effect on recidivism of basic skills teaching directed at prisoners diagnosed as having low basic skills and found that 30% of those who completed the programme (i.e. achieved grade 8) returned to prison compared with 36% of those who started the programme, but did not complete it, and 42% of those who had withdrawn from it. The largest reductions in recidivism were for young offenders and for violent offenders followed by longer sentence offenders[12].

It is not clear that these associations of recidivism and completion of the course are causal. It is possible that completion is a marker for the intentions of prisoners but, nonetheless, the Canadian study is part of a body of evidence pointing to the importance of basic education in the rehabilitation of offenders (Home Office, 1997). As many studies have shown, one of the most effective means of combating crime is through the provision of employment opportunities for people leaving prison (Nuttall et al., 1998). The stigma of prisoner status puts off many potential employers. When lacking basic skills the ex prisoner is doubly disadvantaged. Such problems are compounded in a changing labour market, where unskilled manual work has dramatically declined and ever more emphasis is placed on qualifications and certification.

[12] Thus there were only 31% recidivists among the young offenders who had completed the training compared with half of those who had withdrawn from the course. In the case of violent offenders the figures were 28% (completed) compared with 47% (withdrawn). For longer sentence offenders the figures were 24% (completed) compared with 39% (withdrawn).

4. Concluding remarks

This report represents an attempt to begin to get to grips with the immensely wide-ranging and substantial wider benefits of learning. The Centre for Research on the Wider Benefits of Learning, together with the Department for Education and Skills (DfES), has identified crime, health, ageing, parenting and social cohesion as key areas in which wider benefits are likely to be particularly important and to have costable implications for the UK tax-payer, as well as being important in personal terms.

This report has attempted to show that the wider crime benefits of learning are substantial and approachable statistically. Yet there are still major doubts and uncertainties. The estimates presented in this report need to be read with considerable caution and to be seen as indicative only.

The wider benefits have been approached quantitatively in this report but the Centre for Research on the Wider Benefits of Learning has also been running a programme of qualitative work to understand in much more detail the causal mechanisms and mediating processes that bear on the wider benefits of learning throughout the life course. Among other things, that programme will have important results for how the Centre approaches these issues quantitatively. It will help in establishing the theoretical basis for the effects demonstrated in this report. This is important because, in a multi-disciplinary area of this kind, theoretical explanations are still relatively weak.

This report is, therefore, a first step in the wider benefits programme. In future the Centre will draw on wider data, develop the theoretical implications of the qualitative programme and draw more strongly from the wider research community.

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Appendix 1: Relation between area-level education and training qualifications the log of the 25th percentile of the wage, England & Wales, 2000

	All FT workers	All Men (dependent variable is the log of the 25th percentile of Male Wage Distribution)	Men aged 16-24 (dependent variable is the log of the 25th percentile of Young Male Wage Distribution)
	(1)	(2)	(3)
Degree	1.693	1.759	0.848
	(0.445)	(0.332)	(0.671)
A Level	1.641	2.104	1.026
	(0.611)	(0.384)	(0.345)
O Level	0.889	1.088	0.226
	(0.475)	(0.287)	(0.272)
Under O Level	-0.204	0.394	0.888
	(0.359)	(0.314)	(0.153)
Age 25 to 34	0.041	1.341	
	(0.362)	(0.385)	
Age 35 to 49	0.392	1.173	
	(0.429)	(0.388)	
Age 50 to 65	0.518	1.586	
	(0.450)	(0.488)	
Female	-0.183		
	(0.265)		
Observations	57	57	57
R-squared	0.81	0.83	0.78

Notes:

1. Qualifications defined as in Appendix 3.
2. Weighted least squares regression, where the weights are the inverse of the number of observations in each county.
3. Robust standard errors in parentheses.
4. Significant at 5%; significant at 1%
5. For further detail on educational definitions see Appendix 3.
6. Industry controls also included (0=agriculture, forestry, fishing; 1= energy & water supply; 2= minerals, ores, metals, chemicals; 3= metal goods, engineering, vehicles; 4= other manufacturing industries; 5= construction; 6= distribution, hotels & catering, repair; 7= transport and communication; 8= banking, financial & business services; 9= other services).

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Appendix 2: Relation between area-level education qualifications and the log of the 25th percentile of the wage, England & Wales, 2000

	All FT workers	All Men (dependent variable is the log of the 25th percentile of Male Wage Distribution)	Men aged 16-24 (dependent variable is the log of the 25th percentile of Young Male Wage Distribution)
	(1)	(2)	(3)
Degree	1.486	1.569	0.966
	(0.479)	(0.406)	(0.759)
Higher	1.622	2.113	1.117
	(0.614)	(0.507)	(0.399)
A Level	0.867	1.234	0.627
	(0.486)	(0.360)	(0.283)
GCSE A-C	0.981	0.718	0.150
	(0.526)	(0.467)	(0.315)
Other quals.	-0.060	0.413	1.278
	(0.373)	(0.420)	(0.394)
Age 25 to 34	0.060	0.950	
	(0.331)	(0.424)	
Age 35 to 49	0.224	0.678	
	(0.360)	(0.435)	
Age 50 to 65	0.339	1.054	
	(0.442)	(0.545)	
Female	-0.473		
	(0.355)		
Observations	57	57	57
R-squared	0.80	0.82	0.78

Notes:

1. Weighted least squares regression, where the weights are the inverse of the number of observations in each county.
2. Robust standard errors in parentheses.
3. Significant at 5%; significant at 1%.
4. For further detail on educational definitions see appendix 1.
5. Industry controls also included (0=agriculture, forestry, fishing; 1= energy & water supply; 2= minerals, ores, metals, chemicals; 3= metal goods, engineering, vehicles; 4= other manufacturing industries; 5= construction; 6= distribution, hotels & catering, repair; 7= transport and communication; 8= banking, financial & business services; 9= other services).

Appendix 3: Classification of academic and vocational qualifications used in Appendix 1

Degree
Higher degree
NVQ Level 5
First degree
Other degree

A Level and above
NVQ Level 4
Diploma in Higher Education
HNC, HND, BTEC, etc, Higher
Teaching, further education
Teaching, secondary education
Teaching, primary education
Teaching, Level not stated
Nursing etc
RSA Higher Diploma
Other Higher Education below degree

NVQ Level 3
GNVQ Advanced
A Level or equivalent

O Level and above:
RSA Advanced Diploma
OND, ONC, BTEC etc, National
City & Guilds Advanced Craft
Scottish CSYs
SCE Higher or equivalent
AS Level or equivalent
Trade Apprenticeship
NVQ Level 2
GNVQ Intermediate
RSA Diploma
City & Guilds Craft
BTEC, SCOTVEC First or General Diploma etc
O Level, GCSE grade A-C or equivalent

Under O Level:
NVQ Level 1
GNVQ, GSVQ Foundation Level
CSE below grade1, GCSE below grade C
BTEC, SCOTVEC First or General certificate
SCOTVEC modules
RSA other
City & Guilds other
YT, YTP certificate
Other qualification

No qualifications:
No qualifications

WIDER BENEFITS OF LEARNING RESEARCH REPORT NO. 5

Quantitative Estimates of the Social Benefits of Learning, 1: Crime

The wider benefits of learning represent a new and exciting topic of study. There is considerable uncertainty about the effects of learning but a widely held belief that many aspects of life are improved by education, with considerable plausible benefits for the economy. This report describes the available, robust quantitative evidence for effects of learning on crime and models the cost implications of this evidence. Estimations are made in terms of the savings in the reduced social cost of crime if educational investments were successful.

The report stresses the importance of estimation techniques that deal with confounding factors and other sources of bias, particularly the selection bias that results from the fact that people with higher levels of education receive benefits that may be due to a common set of underlying advantages that influence both education and the outcome variables. Econometric techniques are used to deal with this problem.

Despite these techniques, a great many assumptions are required in order to develop costed benefits of education based on the information available. These assumptions are described in the report and the uncertainty they introduce must be remembered when interpreting the results. The exercise has been conducted as a first step in the Wider Benefits of Learning Research Centre programme of quantitative research. All conclusions are therefore given tentatively and thought of as indicative only.

Dr Leon Feinstein is the Research Director for the Centre for Research on the Wider Benefits of Learning.

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